THE EFFECTS OF PERFORMANCE ASSESSMENT ON MATHEMATICS LEARNING OUTCOMES

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ABSTRACT

This study aims at examining the effect of performance assessment implementation on mathematics learning outcomes viewed from the cognitive style by controlling the mathematical logical intelligence. It was conducted on public high school students in Buleleng district using an experimental method with treatment by level 2 × 2. The samples were 144 science-majored tenth graders chosenwith random sampling technique. The data were analyzed by univariate covariance analysis using IBM SPSS 24.0 for Windows with the significance level (α)=0.05. The results show that 1) students who learned with performance assessment showedhigherlearning outcome than thoselearning with conventional assessment, 2) there was an influence of the interaction between the assessment model and the cognitive style on the mathematics learning outcomes, 3) forstudents with field independent cognitive style,those who learned with performance assessment performed better than the ones learningwith conventional assessment, and 4) for students with field independent cognitive style, those who learnedwith performance assessment had lower learning outcomes than those learning with conventional assessments. The findings indicate that performance assessment and cognitive style had a significant effect on mathematics learning outcomes, after controlling the mathematical logical intelligence.

Keywords: Cognitive Style, Conventional Assessment, Mathematics Learning Outcomes, Logical Intelligence, Performance Assessment

INTRODUCTION

The Indonesian government has made efforts to reform education by changing the Education Unit Level Curriculum (Kurikulum Tingkat Satuan Pendidikan-KTSP) to become the 2013 Curriculum (Kurikulum 2013- K13). Efforts to improve the quality of learning have also been made through Permendikbud Number 53 of 2015 concerning the Assessment of Learning Outcomes by Educators and Education Units in Primary and Secondary Education. Assessment of learning outcomes is carried out in a planned and systematic manner to monitor the process, learning progress, and improvement of learning outcomes through assignments and evaluation of learning outcomes.

However, some studies have found that learning outcomes are not satisfactory, especially in mathematics. It is evidenced by the low results of the Trends in International Mathematics and Science Study (TIMSS) in 2015 showing that the achievement of mathematics abilities of Indonesian students reached an average score of 397 and was ranked 44 out of 49 participating countries (Hadi, 2019). The results of the Program for International Student Assessment (PISA) study in 2015 showed that the achievement of mathematics abilities of Indonesian students reached an average score of 386 and was ranked 63 out of 69 participating countries (Pratiwi, 2019). The findings of the TIMSS and PISA tests suggest that there are concerns with learning results in mathematics. Until recently, many educators have insufficient professionalism to evaluate learning outcomes, especially in secondary education (Latief & Sari, 2017). The evaluation used so far is a traditional evaluation, which during the evaluation, emphasizes closed questions and uses an objective test format. Consequently, with a propensity to memorize, students can only be assisted to the most basic level of comprehension.

Exposure to this situation suggests that the need to apply an evaluation, namely, adhering to constructivism, is in line with the current educational paradigm. The evaluation method used in the students' constructivism-centered learning process is performance evaluation (Sabri, 2018). Authentic evaluation enhances the real-life sense, giving students opportunities to model and learn about potential actions and strategies that lead to a challenge (Ayo, 2015). Performance evaluation allows students to produce responses or items that show their skills and abilities; performance assessment can take a number of forms, including conducting tests, writing extended essays, and performing mathematical calculations. The findings of this study are in line with the view of Uno (2010) that cognitive style is one of the factors that is considered important for learning conditions because they represent students' individual qualities. Cognitive style defines the behavioral characteristics that remain in a person to obtain, think about, and solve problems and store knowledge (Keefe, 1987).

Cognitive style refers to the cognitive processes of a person that are linked to awareness, comprehension, interpretation, reasoning, creativity, and problem solving (Uno, 2010). Cognitive style is one's way of structuring what they see, remember and believe (Slameto, 2010). The findings revealed that the achievement of learning outcomes is also affected by the intelligence factor. It is supported by the findings of Sirih's (2019) research that the relationship between learning outcomes and co-variables of mathematical logical intelligence indicates that mathematical logical intelligence impacts learning outcomes and may boost learning outcomes with mathematical logical intelligence. It is claimed that the ability to use numbers efficiently and to reason well is mathematical logical intelligence (Hajhashemi et al., 2018).

Intelligence influences learning growth according to Slameto (2010). The purpose of learning mathematics is to inspire students to become problem solvers based on logical and critical thinking processes (Jamaris Martini, 2014). Subini (2011) adds that to have high mathematical logical intelligence, a person who thinks logically, linearly, periodically, is able to count and reason is needed. Mathematical logical intelligence is the capacity to focus and think objectively on mathematical issues (Gangadevi, 2014). Logical mathematical intelligence requires the ability to evaluate problems objectively, use mathematical functions, and scientifically examine problems often associated with science and mathematical thought (Gasm & Ahmed, 2012). These views indicate that mathematical learning results are affected by rational intelligence in mathematics.

LITERATURE REVIEW

Performance Assessment

Performance assessment consists of the word "assessment" meaning evaluation and "performance" meaning the tasks performed (performance) (Anak Agung Istri Ngurah Marhaeni et al., 2017). In this case, the evaluation is directed at students especially the evaluation of student success in relation to the tasks that have been carried out.

One type of authentic evaluation is performance evaluation (Hairida & Junanto, 2018). Authentic evaluation enhances the real-life sense, giving students opportunities to model and learn about potential actions and strategies that lead to a challenge (Ayo, 2015).

The method of gathering data on problem-solving, reasoning and communication abilities is performance evaluation (Kartinah, 2014). The ability to consider problems, make proposals for solutions, solve problems, and verify the outcomes of solutions involves problem solving. The ability to formulate and prove a hypothesis, draw conclusions and offer justifications is involved in reasoning. Communication requires the ability to make presentations using simple words, clarify and justify ideas and use vocabulary appropriately.

Learning Outcomes

Learning outcomes are described as what learners know, understand and can do after they have completed learning (Harris & Clayton, 2019). The benefits of learning can be directly assessed with numbers and can be seen in everyday life practices (Triarisanti & Purnawarman, 2019). Learning results are often referred to as skills or abilities (Azwar, 2015). It is possible to divide ability into real and potential capability. Real capacity is the ability of students to complete tasks without the help of others while potential capacity is the ability of students to complete tasks with the help of others (Pratama et al., 2019). Based on these views, it can be argued that learning outcomes are actual abilities gained after learning by learners, not future abilities, since after taking a test, these learning outcomes can be seen in real terms in the form of values. Measurement of learning outcomes refers to Bloom's taxonomy which has been revised by Anderson & Krathwohl (2010) which includes the cognitive domain, where each domain has a dimension of knowledge. That is, the cognitive realm of remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6) each has dimensions of factual knowledge (K1), conceptual knowledge (K2), procedural knowledge (K3), and metacognitive knowledge (K4).

Mathematical Logical Intelligence

Mathematical logical intelligence is defined as the ability to efficiently use numbers and reason well (Hajhashemi et al., 2018). For learning results, mathematical logical knowledge may be used as a covariate. The relationship between learning outcomes and logical mathematical intelligence shows that logical mathematical intelligence influences learning outcomes, and logical mathematical intelligence can enhance learning outcomes (Sirih, 2019). There are typically several factors associated with mathematical logical intelligence assessment, namely mathematical estimation, problem solving, inductive reasoning (scientific translation from particular to general), deductive reasoning (general to specific scientific translation), and the sharpness of patterns and relationships (Uno & Masri, 2010).

Cognitive Style

Cognitive style is the preferred way for people to organize and process data, typically characterized as a dimension of personality that affects attitudes, values and social interactions (Lambertus et al., 2019). In terms of thinking, recalling, processing information, and solving problems, cognitive style is a pattern for individual consistent characteristics (not necessarily meaning that individual characteristics cannot be changed) (Lambertus et al., 2019).

The cognitive style consists of cognitive types dependent on the field (FD) and independent on the field (FI) (Minchekar, 2017). Individuals with a cognitive style that is separate from the field are more independent and intrinsically driven with self-directed objectives and can write their own learning and establish their own strategies with needs at least for instructor guidance (Hamed Mahvelati, 2019). The autonomous cognitive style of the field is a cognitive style that appears to be analytically capable of evaluating clear and distinct components from the real context (Sofnidar et al., 2019). In analytical tasks, field-independent cognitive styles tend to be higher, can solve complex problems, remember information, interpret objects as having different characteristics from their meaning, generally can easily and accurately encode information, and can perform well on standardized tests. The cognitive style based on the field is a cognitive style that appears to be difficult to evaluate clearly from its original context and is easily affected by the environment. It has not been able to analytically determine components that are clear and distinct from the real context (Suharta & Suarjana, 2018).

METHOD

Sample

The samples were 144 science-majored tenth graders. The students studied in two different public schools. In choosing the sample, the researchers used a random sampling technique. Prior to applying the random sampling technique, an equivalence test was conducted.

Research Design

This study aims to evaluate the impact of performance assessment and cognitive style by regulating mathematical logical intelligence on mathematics learning results. This method of quasi-experimental study is used because the constraints that cannot be managed by all other variables influencing research are taken into account (Sugiyono, 2018). An experimental research design in the context of the Non-Equivalent Post-Test Only Control Group Design was the research design used. Treatment by level 2×2 was used in the experimental design of this research. The reason for choosing this design was that the research was conducted by involving two or more variables; any possible combination amount of both variables could be tested with a factorial design (Salomon et al., 2017).

Instrument

The research instrument is a survey. The test was used to assess the mathematical logical intelligence factors, cognitive style, and learning outcomes of student mathematics. For the mathematics learning outcomes test, each instrument has a reliability coefficient of 0.842, 0.823 for the cognitive style test, and 0.890 for the test of mathematical logical intelligence. The test of mathematics learning outcomes shows the scores obtained by students in responding to the test of mathematics learning outcomes that define the level of cognitive skills that include the dimensions of the cognitive process and the dimension of information. The form of the test used in this research is a form of description developed by Anderson & Krathwol (2010) based on the revised taxonomic dimension of Bloom.

In the form of a Group Embedded Figure Test (GEFT), the cognitive style test displays the scores obtained by students after working on a cognitive style test that contains the dimensions of the field-independent cognitive style and the field-dependent cognitive style. The standardized test developed by Witkin, et al., (1977), which was translated into Indonesian, is the type of cognitive style test used. With measures of mathematical calculation ability, logical thought, problem solving, inductive and deductive reasoning as well as pattern and relationship acuity, the mathematical logical intelligence test demonstrates the scores obtained by students in responding to the mathematical logical intelligence test. An objective test in the form of multiple choices built based on the Uno and Quadratic dimensions (2010) is the mathematical logical intelligence test used in this analysis.

Procedure

The experiment in this analysis was performed in three steps, namely the initial phase, the data collection and experimental phase, and the final phase. Identifying the study community, choosing the schools to be sampled, gathering regular test data for the equivalence test, measuring equality, determining the class as the research sample, determining the class as the experimental group and the control group, planning the evaluation rubric and instruments were the tasks carried out during the early stages. Testing in the form of experiments, validating the instrument, and planning the treatment designs in the form of lesson plans and worksheets, and designs for trial treatment.

The activities carried out during the experimental and data collection stages were determining the students' cognitive style, collecting students' mathematical logical intelligence data, conducting the experiment phase I in the experimental class 6 times face to face, each 3 × (2 × 45) minutes and 3 × (1 × 45) minutes. Data collection of mathematics learning outcomes at stage I, implementation of experiment phase II in the experimental class as much as 6 times face to face each of 3 × (2 × 45) minutes and 2 × (1 × 45) minutes, and data collection of phase II mathematics learning outcomes. The detailed description of each stage accompanied by its relevant activities for the performance assessment is presented in Table 1.

Table 1
Mathematics Learning Syntax with Performance Assessment

Learning Steps	Performance Assessment Activities
a. Observing	
1) Showing a natural phenomenon related to learning material	Observing students' abilities in understanding the problem
2) Addressing the problem, giving student worksheets and students looking for learning materials related to worksheets through various sources	Observing students' abilities in formulating and proving a hypothesis or hunch
b. Asking	
Confirming the procedures and steps in working on worksheets	Observing students' abilities in making completion plans
c. Trying	
1) Giving orientation skills to analyze problems and cooperation in groups	Observing of students' ability to solve problems
2) Implementing problem-solving discussion activities	Observing students' abilities in checking the results of completion
d. Associating	
1) Discussing while solving problems related to the questions in the worksheet book	Observing of students' ability to use a clear language to make presentations, and to explain and justify solutions when reporting for different purposes and audiences
2) Discussing and preparing the presentation	
e. Communicating	

1) Presenting the results of the problem-solving discussion on the worksheet to show the results of their work	Observing students' ability in using mathematic vocabulary appropriately
2) Expressing individual opinions related to the examination of the results of problem solving	
3) Providing feedback on the results of discussion activities	

The final stage of the research is the data analysis stage, starting from analyzing student response sheets, data entry, descriptive analysis, testing the prerequisites for data analysis, testing hypotheses, to drawing conclusions about research findings.

DATA COLLECTION AND DATA ANALYSIS

The data were analyzed with descriptive statistics showing the mean minimum, maximum, standard deviation, variance, set of variables of mathematical logical intelligence, cognitive style, and learning outcomes of student mathematics. The data collected were then analyzed to test the research hypothesis using the two-way ANACOVA F test at the significance level $\alpha=0.05$. Calculations are assisted with the help of the IBM SPSS 24.0 for Windows program. The acceptance criteria for H0 are determined based on the significance number $F<0.05$ ($p<0.05$). The classical assumption test includes testing: (1) normality, (2) homogeneity of variance between groups, (3) regression linearity, (4) meaning of regression direction, and (5) alignment of regression lines.

FINDINGS

The data of this research are grouped into: 1) mathematical logical intelligence data of students who took mathematics learning with performance assessment, 2) mathematical logical intelligence data of students who took mathematics learning using conventional assessment, 3) mathematics learning outcomes data of students who took mathematics learning with performance assessment, 4) mathematics learning outcomes data of students who took mathematics learning with conventional assessment, 5) mathematics learning outcomes data of students who took mathematics learning with performance assessment and had field independent cognitive style, 6) mathematics learning outcomes data of students who took mathematics learning with conventional assessment and had independent field cognitive style, 7) mathematics learning outcomes data of students who took mathematics learning with performance assessment and had field dependent cognitive style, and 8) mathematics learning outcomes data of students who took mathematics learning with conventional assessment and had field cognitive style dependent.

The first group of data shows that 27.08% of students obtained scores around the average, 47.92% of students obtained scores above the average, and as many as 25.00% obtained scores below the average. Thus, the mathematical logical intelligence score data of students who took mathematics learning with performance assessment is classified in the high category. From the second group of data, it is shown that 31.25% of students obtained scores around the average, 22.92% of students obtained scores above the average, and 15.28% obtained scores below the average. Referring to the description of the second group of data, the mathematical logical intelligence score data of students who took mathematics learning with conventional assessment is classified in the high category.

The third group of data shows that 10.42% of students obtained scores around the average, 52.08% of students obtained scores above the average, and as many as 37.50% obtained scores below the average. Referring to the description of the data above, the mathematics learning outcomes data of students who took mathematics learning with performance assessment are classified in the high category. The data from the fourth group shows that 16.67% of students obtained scores around the average, 43.75% of students obtained scores above the average, and as many as 39.58% obtained scores below the average. Therefore, the mathematics learning outcomes data of students who took mathematics learning with conventional assessment are classified in the high category.

The fifth group of data shows that 8.33% of students obtained scores around the average, 45.83% of students obtained scores above the average, and 45.83% obtained scores below the average. Thus, the mathematics learning outcomes data of students who took mathematics learning with performance assessment and had field independent cognitive style are classified in the high category. From the sixth group of data, it is shown that 20.83% of students obtained scores around the average, 37.50% of students obtained scores above the average, and 41.67% obtained scores below the average. Thus, the data on the score of mathematics learning outcomes of students who took mathematics learning using conventional assessment and field independent cognitive style classified in the high enough categories.

The seventh group of data shows that as many as 25.00% of students obtained scores around the average, 41.67% of students obtained scores above the average, and as many as 33.33% obtained scores below the average. Referring to the description of the data above, the data on the score of mathematics learning outcomes of students who took mathematics learning with performance assessment and had field dependent cognitive style are classified in the high category. The eighth group of data shows that 12.50% of students obtained scores around the average, 50.00% of students obtained scores above the average, and 37.50% obtained scores below the average. Thus, the data on the score of mathematics learning outcomes of students who took mathematics learning with conventional assessment and had dependent field cognitive style are classified in the high enough categories.

From the result of the data distribution normality test, it is found that the entire data group of mathematical logical intelligence scores and math study scores of students in this study came from normally distributed populations. It is also found that the data group of mathematical logical intelligence scores and scores of students’ math learning results has homogeneous variances from the group variance homogeneity test. The result of the regression linearity test shows that the regression between covariable mathematical logical intelligence and variable mathematical learning outcomes has a linear relationship. Further, the result of the meaning of regression direction test shows that the mathematical logical intelligence covariate has a significant linear influence on the results of learning mathematics. The result of the regression line alignment test shows that the regression lines of mathematical logical intelligence and the results of students' mathematical learning from assessment model factors and cognitive styles in this study are parallel.

From the first hypothesis testing, it is found that there are differences in mathematics learning outcomes between students who learned with performance assessment and students who learned with conventional assessment after controlling mathematical logical intelligence. The second hypothesis testing shows that there is an influence of the interaction between assessment forms and cognitive style on mathematics learning outcomes after controlling mathematical logical intelligence. The third hypothesis testing shows that there are differences in mathematics learning outcomes between students who learned with performance assessment and students who learned with conventional assessments after controlling mathematical logical intelligence for students who had field independent cognitive style. From the fourth hypothesis testing, it is found that there are differences in mathematics learning outcomes between students who learned with performance assessment and students who learned with conventional assessments after controlling mathematical logical intelligence for students who had field dependent cognitive style.

DISCUSSION

The main results of the study show that the performance assessment and cognitive style have a significant effect on mathematics learning outcomes controlling mathematical logical intelligence. First, testing with ANACOVA F-test shows the value of F=7.102 with a significance value of 0.009 (p<0.05). It is concluded that there are differences in mathematics learning outcomes between students who learned with performance assessment and students who learned with conventional assessment after controlling mathematical logical intelligence. The results of further tests using the Least Significant Difference (LSD) show that the average difference between the students' mathematics learning outcomes between the group of students who took mathematics learning with performance assessment and the group of students who learned using conventional assessment was 3.759 with a significance value of 0.009 (p<0.05). Furthermore, referring to the results of the descriptive analysis, it can be seen that the average score of mathematics learning outcomes in the group of students who learned with performance assessment was 63.71; while the average score of mathematics learning outcomes in the group of students who learned using conventional assessment was 59.54. This means that the mathematics learning outcomes of students who learned mathematics with performance assessment were higher than the mathematics learning outcomes of the students who learned mathematics with conventional assessment after mathematical logical intelligence was controlled.

Second, the testing with ANACOVA on the univariate test on the effect of the interaction between assessment models and cognitive styles on mathematics learning outcomes, after controlling mathematical logical intelligence, it shows the value of F=32.056 with a significance value of 0.000 (p<0.05). It can be concluded that there was an interaction effect between the assessment model and cognitive style on mathematics learning outcomes, after mathematical logical intelligence was controlled.

Third, the testing with ANACOVA on the univariate test on differences in mathematics learning outcomes between students who take mathematics learning with performance assessment and the students who learned mathematics with conventional assessment after controlling mathematical logical intelligence for the students who had field independent cognitive style shows the value of F=33.471 with a significance value of 0.000 (p<0.05). It was concluded that there were differences in mathematics learning outcomes between the students who learned with performance assessment and the students who learned with conventional assessment after controlling mathematical logical intelligence in the students who had field independent cognitive style. Pair wise comparison test results show that for students who had a cognitive style field independent of the average difference in students' mathematics learning outcomes between groups of students who learned mathematics with performance assessment and groups of students who learned mathematics with conventional assessment of 11.737 was significant. Furthermore, referring to the results of descriptive analysis, it can be seen that for the students who had a field independent cognitive style the average score of mathematics learning outcomes in the group of students who learned mathematics with performance assessment was 72.21; while the average score of mathematics learning outcomes in the group of students who learned mathematics using conventional assessment was 59.08. This means, for the students who had a field independent cognitive style, the mathematics learning outcomes of students who learned mathematics with performance assessment were higher than the mathematics learning outcomes of those who learned using conventional assessment, after mathematical logical intelligence was controlled.

Fourth, testing with ANACOVA on the univariate test on the differences in mathematics learning outcomes between students who learned mathematics with performance assessment and those who learned with conventional assessment after controlling mathematical logical intelligence for students who had a field dependent cognitive style, shows a value of F=4.483 with a significance value of 0.040 ($p<0.05$). It was concluded that there were differences in mathematics learning outcomes between the students who learned with performance assessment and those who learned with conventional assessment after controlling mathematical logical intelligence in students who had a field dependent cognitive style. Pair wise comparison test results show that for students who had a field dependent cognitive style the average difference between the students' mathematics learning outcomes between groups of students who learned mathematics with performance assessment and groups of students who learned mathematics using conventional assessment was 4.378 is significant. Furthermore, referring to the results of descriptive analysis, it can be seen that for students who had a field dependent cognitive style the average score of mathematics learning outcomes in the group of students who learned mathematics with performance assessment was 55.21; while the average score of mathematics learning outcomes in the group of students who learned mathematics using conventional assessment was 60.00. This means, for students who had a field dependent cognitive style, the mathematics learning outcomes of students who learned mathematics with performance assessment were lower than the mathematics learning outcomes of students who learned using conventional assessment, after mathematical logical intelligence was controlled.

The influence of performance assessment on mathematics learning outcomes was caused by the characteristics of the performance assessment itself. It shows that performance assessment requires students to express their thoughts and understanding in solving problems and not ask for a single answer to a series of answers that have been provided. Performance assessment provides students with sufficient opportunities to discover and create new knowledge and opportunities to practice what they have to improve students' learning outcomes (Kristin & Cebulla, 2000). The results of this study support the opinion of psychologists such as Stiggins (1994), who states that performance appraisal involves students in an activity that requires students to show their abilities either in skills or being creative about certain products as a manifestation of mastery of knowledge. It is further explained that the application of performance assessment in mathematics learning can increase persistence in learning mathematics, improve skills, increase students' learning independence and increase learning activities which will lead to increased students' learning outcomes.

It is different from the classroom situation where the learning uses conventional assessment. The opportunity for students to carry out their learning activities according to their needs, abilities and interests as well as opportunities for self-reflection from self-evaluation and feedback are very minimal in the implementation of conventional assessments (Marhaeni, 2008). Even though these opportunities provide a very broad space for these students to spur their achievement to excel. This assessment paradigm has been commonly used around the world for the reasons for time and cost efficiency (Popham, 1975). Students' assignments and performance tend to be ignored and are not taken into account as a more meaningful alternative assessment. Pure multiple-choice tests contribute less to learning and are therefore not appropriate for all assessments carried out in schools. Conventional assessment cannot measure students' actual abilities because it only focuses on a few aspects so that it does not provide opportunities for students to show their respective abilities and strengths. This shows that conventional assessment is only able to develop the most basic understanding with a tendency to memorize.

Empirically, the results of this study are supported by the results of previous research conducted by Mahendra (2015) that the mathematics learning outcomes of students who were given performance assessments were higher than students who were given conventional assessments. The same results are also shown by Tejedaa & Gallardo (2017), who show that changing the assessment method from conventional assessment to performance assessment could be a clearer approach to understanding the strengths and weaknesses of students in mathematics learning. The results of the study conducted by Niroo, et al., (2012) shows that there was a significant relationship between mathematical logical intelligence and students' cognitive abilities in mathematical functions. That is, if mathematical logical intelligence is higher, the cognitive ability of students in mathematical functions will also be higher.

The results of this study are also in accordance with the results of the research conducted by Tilaar (2014), which shows that the implementation of performance assessment had a significant effect on the average students' achievement. In line with that, Haryati (2013) states that there were differences in mathematics learning achievement between the students who take the cooperative learning model of the Student Teams Achievement Division (STAD) type based on performance assessment and those who take the conventional learning model, where mathematics learning achievement in the cooperative learning model with STAD type is higher than conventional learning models.

Other relevant research was conducted by Suhendri (2012), which shows that there was a positive and significant effect of mathematical logical intelligence on mathematics learning outcomes. That is, the higher the mathematical logical intelligence is, the higher the mathematics learning outcomes will be. The results of these studies provide empirical evidence that learning mathematics with performance assessment is superior to learning mathematics using conventional assessment and indicate that mathematical logical intelligence has contributed to variations in students' mathematics learning outcomes so that it is feasible to control its effects.

The interaction between the assessment form and the cognitive style on mathematics learning outcomes after controlling mathematical logical intelligence is due to the suitability of the characteristics of the cognitive style with the type of assessment used. Sudarman, et al., (2016) revealed that there are differences in the achievement of learning outcomes between groups of students with different cognitive styles. Cognitive styles can be divided into Field Dependent (FD) and Field Independent (FI) (Popham, 1995). Field Dependent (FD) and Field Independent (FI) styles are types of cognitive styles that reflect the way a person analyzes interacting with their environment (Slameto, 2010). Students who are in the dependent region tend to accept one pattern as a whole. They find it difficult to focus on one aspect of a situation or analyze a pattern into different parts. Meanwhile, people who are in the independent category usually accept separate parts of the overall pattern and are able to analyze the pattern into its components (Woolfolk & Lorrance, 2004). According to Candiasa (2002), the general characteristics of individuals who have a field independent cognitive style include: 1) inclined to reorganize learning materials according to their own interests, so that they are less interested in learning materials that are well organized, 2) inclined to determine their own goals learning and defining it internally and 3) when learning, they prioritize internal motivation, while individuals who have a field dependent cognitive style include: 1) inclined to follow the structure of learning material as is, so they want materials that is well structured, 2) inclined to follow learning objectives that exist and are defined externally and 3) in learning, they prioritize external motivation. Performance assessment is very suitable to be applied to students who have a Field Independent cognitive style (FI) because they have an analyst character, who are able to solve problems, have the ability to remember, have high accuracy, are self-motivated, and tend to be active in the learning process. The application of conventional assessment is in accordance with students who have a Field Dependent cognitive style (FD) because they do not have the initiative to organize the existing learning material structure. Material construction is still very dependent on other people.

Empirically, the results of this study are supported by the results of previous studies conducted by Sudarman, et al., (2016) that there were differences in the achievement of learning outcomes between groups of students with different cognitive styles. Mertasari (2014) found that the formative assessment model interacts with cognitive styles in their effect on Meta cognitive abilities in mathematics learning. Field independent students tended to be more suited to performance assessments, while field dependent students tended to be more compatible with description assessment.

CONCLUSION

Based on the results of the hypothesis testing and the discussion of research results, the findings of this study are: (1) there are differences in mathematics learning outcomes between students who learned with performance assessment and those who learned with conventional assessment after controlling mathematical logical intelligence, which is shown by the value of F=7.102 with a significance value of 0.009 ($p<0.05$); (2) there is an interaction effect between the assessment form and cognitive style on mathematics learning outcomes after controlling for mathematical logical intelligence, which is indicated by the value of F=32.056 with a significance value of 0.000 ($p<0.05$); (3) there are differences in mathematics learning outcomes between students who learned with performance assessment and students who learned with conventional assessment after controlling for mathematical logical intelligence in students who had field independent cognitive style, which is indicated by the value of F=33.471 with a significance value of 0.000 ($p<0.05$); and (4) there are differences in mathematics learning outcomes between students who learned with performance assessment and students who learned with conventional assessment after controlling mathematical logical intelligence in students who had a field dependent cognitive style, as indicated by the value of F=4.483 with a significance value of 0.040 ($p <0.05$).

Concerning the research results obtained, several recommendations that can be put forward are as follows: (1) the principal should provide facilities and infrastructure needed in mathematics learning with performance assessment so that its implementation can run well to obtain maximum learning outcomes; (2) the school committee should provide full support by providing sufficient budget for the provision of facilities and infrastructure needed in mathematics learning with performance assessment so that its implementation can run well to obtain maximum learning achievement; (3) the government, especially the Education, Youth and Sports Office of Buleleng Regency, need to provide training for teachers on the use of performance assessment models to improve the quality of education; and (4) further research related to the assessment of performance and cognitive styles in mathematics learning needs to be done with other mathematics materials involving a wider sample.

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